IS 10106-2-1 (1985): Packaging code, Part 2: Packaging materials,Section 1 Metals [TED 24: Transport Packages]

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IS : 10106 (Part 2/Sec 1) - 1985

Indian Standard

PACKAGING CODE

PART 2 PACKAGING MATERIALS

Section 1 Metals

UDC 621·798·1 [669·015]:006·76

INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 3

May 1986

Indian Standard

PACKAGING CODE

PART 2 PACKAGING MATERIALS

Section 1 Metals

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Indian Standard

PACKAGING CODE

PART 2 PACKAGING MATERIALS

Section 1 Metals

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 14 March 1985, after the draft finalized by the Packaging Code Sectional Committee had been approved by the Marine, Cargo Movement and Packaging Division Council.

0.2 This packaging code is being issued in the following parts which have one or more sections.

Part 1	Product Packaging
Part 2	Packaging Materials
Part 3	Ancillary Materials
Part 4	Packages
Part 5	Packaging Operations
Part 6	Storage and Transportation
Part 7	Packaging Machinery
Part 8	Testing

This section of packaging code (Part 2/Sec 1) deals with metals.

0.3 The main metals used in packaging are tinplate, black plate, aluminium and its alloys, galvanized steel sheets, mild steel sheets, stainless steel sheets and tinfree steel sheets.

0.4 In this section of the code, metals being currently used are described and both, their properties and their suitability for various packaging applications are given. This code is, therefore, intended to assist the manufacturer and user of metal containers in the choice of metals suitable for their purpose of use.

0.4.1 The types and details of the metal containers are described in Part 4, Section 1 of the packaging code.

0.5 In the preparation of this standard, considerable assistance has been derived form BS: 1133 (Section 10)-1966, Packaging Code : Metal Containers, issued by the British Standards Institution (BSI).

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS: 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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1. SCOPE

1.1 This packaging code (Part 2/Section 1) describes the characteristics and properties of the various metals and lays down guidelines for the selection of material for various types of metal containers used as unit packs and bulk packs.

2. TERMINOLOGY

2.1 For the purpose of this code, the definitions given in IS: 1394-1973† shall apply.

3. CHARACTERISTICS OF METALS

3.0 Different materials used for the manufacture of the various types of metal containers are described below.

3.1 Tinplate — Low carbon mild steel sheet coated on both sides with a very thin film of tin. The tin coating can be applied either by hot dipping the black plate in molten tin or by a process of electro-deposition. For more details about tinplate and black plate, reference may be made to IS : 1993-1982‡.

3.1.1 *Types* — The following types of tinplate are those normally used in the tin container industry:

a) *Hot dipped tinplate* — A continuous coil of steel is cold rolled to the required thickness and subsequently tinned by passing the coil or precut sheets through a hot tinning pot.

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*Rules for rounding off numerical values (*revised*).

†Glossary of terms relating to metal containers trade (*second revision*).

‡Specification for cold-reduced tinplate and cold-reduced blackplate (*second revision*).

b) *Electrolytic tinplate* — A continuous coil of steel is cold rolled to the required thickness and subsequently tinned by passing through an eloctro-deposition process. The tinplate is supplied in either coil form or cut sheets. By the nature of the electro-deposition process, it is possible to produce differentially coated tinplate, which is tinplate having a heavier tin coating on one surface than on the other.

3.1.2 *Grading*

a) *Hot dipped tinplate* — After coating, hot dipped tinplate is inspected and graded as follows:

i) *First Grade (Prime)* — Tinplates which at the time of despatch are free from defects readily visible to the unaided eye. Under normal conditions of storage and use they are suitable for lacquering or printing over the whole surface of the sheet.

ii) *Second Grade* — 'Second' is the grade designation given to hot-dipped tinplate which at the time of despatch has a minimum of 75 percent usable area.

b) *Electrolytic tinplate*

i) *First Grade (Prime)* — Tinplate which at the time of despatch are free from defects readily visible to the unaided eye. Under normal conditions of storage and use, they are suitable for lacquering and printing over the whole surface of the sheet.

NOTE — Normally this quality is not available.

ii) *Second Grade* — 'Second' is the grade designation given to electrolytic tinplate which at the time of despatch has a minimum of 75 percent of usable area.

iii) *Unassorted Grade (Standard)* — This is the grade designation given to electrolytic tinplates, normally produced in line using usual inspection and classification procedures. These contain primes and seconds. The quantity of seconds may be up to 15 percent at the time of despatch.

3.1.3 *Unit of Trading* — Tinplate is sold in units of area, the unit being System International Tinplate Area briefly referred to as SITA. It is the international unit for measuring tinplate area. One SITA is equivalent to 100 square metres. The number of SITA per metric tonne for each thickness of the tinplate is given below:

Nominal Thickness in mm	*No. of SITA/M.T.*
0·19	6·705
0·20	6·370
0·21	6·066
0·22	5·790
0·24	5·248
0·25	5·096
0·26	4·900
0·27	4·695
0·28	4·550
0·30	4·130

3.1.4 *Nominal Thickness* — The nominal thickness represents the average thickness of a sheet of tinplate. Thickness is not determined by using a micrometer, but by weighing a whole sheet and applying the following formula:

$$\text{Nominal thickness, mm} = \frac{\text{Mass (g)}}{\text{Actual area (mm}^2\text{)} \times 0{\cdot}007\,85}$$

3.1.5 *Tin Coating* — The mass of tin coating shall be expressed in g/m² in terms of the quantity of tin present on the two surfaces of the sheets. The figure being prefixed by the initial 'H' in the case of hot-dipped tinplate, E or D in the case of equally or differentially coated electrolytic tinplate respectively.

3.1.5.1 The tin coating masses normally available in the case of hot-dipped tinplate and electrolytic tinplate are given in Table 1. Other coating masses may be supplied as agreed to between the purchaser and the manufacturer.

3.1.6 *Uses* — Tinplate is used as basic material mainly for the manufacture of tins and cans (*see* IS : 9992-1981*, IS : 10325-1982†). It is also used for manufacture of closures for drums (*see* IS : 1994-1971‡ and IS : 2474-1982 §), aerosol valves and dispensers (*see* IS : 9634-1980‖) etc.

*Specification for round and rectangular tinplate cans for liquid pesticides.

†Specification for 15-kg square tins for *vanaspati* and edible oils.

‡Specification for crown closures (*first revision*).

§Specification for metal closures for drums (*first revision*).

‖Specification for aerosol valves — 25·4 mm diameter.

TABLE 1 TIN COATING MASSES

(*Clause* 3.1.5.1)

TYPE OF TINPLATE	CODE	NOMINAL COATING MASS, g/m²	MINIMUM AVERAGE COATING MASS, g/m² (*see* Note 2)
(1)	(2)	(3)	(4)
Hot-dipped tinplate	H11/11	22·4	19·6
	H14/14	28·0	25·2
Electrolytic tinplate equally coated	E2·8/2·8	2·8/2·8	4·9
	E4·2/4·2	4·2/4·2	7·6
	E5·6/5·6	5·6/5·6	10·5
	E8·4/8·4	8·4/8·4	15·7
	E11·2/11·2	11·2/11·2	20·2
Electrolytic tinplate differentially coated	D5·6/2·8	5·6/2·8	5·05/2·25
	D8·4/2·8	8·4/2·8	7·85/2·25
	D8·4/5·6	8·4/5·6	7·85/5·05
	D11·2/2·8	11·2/2·8	10·1/2·25
	D11·2/5·6	11·2/5·6	10·1/5·05
	D15·1/5·6	15·1/5·6	14·0/5·05

NOTE 1 — For hot-dipped tinplate coating, masses are expressed as the total mass of coating on both surfaces as it will be technically difficult to control the tin coating on individual faces.

For equally and differentially coated electrolytic tinplates, the coating mass value is expressed as the mass of coating on each surface separately.

NOTE 2 — The minimum average coating mass values shown represent the minimum permissible values for the arithmetic mean of the sample selected and determined in accordance with **11.1.2** and **12.4** respectively of IS : 1993-1982*.

*Specification for cold-reduced tinplate and cold-reduced blackplate (*first revision*).

3.2 Blackplate — Blackplate is the name given to the base plate of mild steel before tinning. Cold reduced uncoated blackplate can be supplied for applications requiring the use of steel sheet in the tinplate thickness range. It is supplied in the same metallurgical qualities as those of tinplate.

3.2.1 This material is very susceptible to atmospheric corrosion and great care should be taken when handling and warehousing. Conditions most favourable to the prevention of sweating and rusting should be ensured and the plate should be used or treated as soon as possible after delivery. Both surfaces have to be protected with some suitable rust preventive coating.

3.2.2 Blackplate is available in the same three grades as tinplate. It is used for the fabrication of containers where the side seam is either welded or cemented and not soldered.

3.2.3 Blackplate is used for the manufacture of cans (*see* IS:3286-1980* and IS:5241-1969†), closures for drums (*see* IS:2474-1982‡ and IS:1784-1977§), aerosol valves and dispensers (*see* IS:9634-1980‖) etc.

3.3 Aluminium and Aluminium Alloys — Both are loosely referred to as 'aluminium'. They are specified by thickness and size, but marketed by weight. Because aluminium can be worked by the same techniques as those used for tinplate, it has tended to be regarded merely as an alternative material. Aluminium should be regarded as a material having its own characteristics and not as a substitute material. Soldering is not commercially practicable. For more details reference may be made to IS:737-1974¶.

3.3.1 Aluminium and its alloys are used for the manufacture of tins and cans (*see* IS:3603-1966** and IS:9445-1980††), drums and their closures, collapsible tubes (*see* IS:3101-1979‡‡), aluminium bottles (*see* IS:9503-1980§§), glass bottle closures (*see* IS 8393-1977‖‖), vial seals (*see* IS:2123-1977¶¶), aerosol valves and dispensers (*see* IS:9634-1980‖).

3.4 Galvanized Steel Sheets

3.4.1 Galvanized steel sheets shall be made from black sheets or cold-rolled sheets. The black sheets are first pickled and cold-rolled sheets cleaned and then dipped in a bath of molten zinc at a temperature suitable to produce a complete and uniform coating of zinc. For details, reference may be made to IS:277-1977***. These are used for the manufacture of drums. The thickness of sheets for drums are given in Table 2. For other details, *see* IS:2552-1979†††, IS:5682-1981‡‡‡ and IS:1783 (Parts 1, 2 and 3)-1983§§§.

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*Specification for round grease tins (*first revision*).
†Specification for shoe polish containers.
‡Specification for metal closures for drums (*first revision*).
§Specification for screwed closures for drums (*first revision*).
‖Specification for aerosol valves — 25·4 mm diameter.
¶Specification for wrought aluminium and aluminium alloys, sheet and strip (for general engineering purposes) (*second revision*).
**Specification for seamless aluminium containers.
††Specification for aluminium containers for packing liquid pesticides (capacity 5 litres and above).
‡‡Specification for aluminium collapsible tubes (*first revision*).
§§Specification for aluminium bottles for packing of liquid pesticides.
‖‖Specification for roll seal pilferproof closures.
¶¶Specification for vial (goldie) seals (*first revision*).
***Specification for galvanized steel sheets (plain and corrugated) (*third revision*).
†††Specification for steel drums (galvanized and ungalvanized) (*second revision*).
‡‡‡Specification for open top drums and kegs (*first revision*).
§§§Specification for drums, large, fixed ends: Part 1 Grade A Drums, Part 2 Grade B Drums, Part 3 Grade C Drums (*second revision*).

TABLE 2 NOMINAL THICKNESS OF SHEET FOR DRUMS

(*Clause* 3.4.1)

Sl No.	Nominal Capacity l	Sheet Thickness, mm									
		Grade A1		Grade A2		Grade B1		Grade B2		Grade C	
		Body	Ends	Body	Ends	Body	Ends	Body	Ends	Body	Ends
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
i)	3 to 10	0·63	0·63	0·50	0·50	0·50	0·63	0·50	0·50	0·40	0·50
ii)	15 to 25	0·80	0·80	0·63	0·63	0·63	0·63	0·50	0·63	0·50	0·50
iii)	30 to 50	1·00	1·00	0·80	0·80	0·63	0·80	0·63	0·63	0·50	0·63
iv)	75 to 150	1·25	1·25	1·00	1·00	0·80	0·80	0·63	0·80	0·63	0·63

3.5 Mild Steel Sheets — These may be hot-rolled or cold-rolled carbon steel sheets. These are used in manufacture of drums, tins and cans. The various grades and details of mild steel sheets are given in IS : 1079-1973* and IS : 519-1973†. The grades suitable for drums, tins and cans are indicated in the related Indian Standards.

3.6 Tin-Free Steel — Tin-free steel sheet is mild steel with corrosion resistant material other than tin, applied to the surface. The substitute metal is usually chromium and chromic oxide together. Chromium coated steel is almost impossible to solder and difficult to weld. Developments in adhesive bonded side seams are proving useful in this area and welding techniques are likely to be available in due course.

*Specification for hot rolled carbon steel sheet and strip (*third revision*).

†Specification for cold rolled carbon steel sheets (*second revision*).

INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

Quantity	*Unit*	*Symbol*
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

Quantity	*Unit*	*Symbol*
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

Quantity	*Unit*	*Symbol*	*Definition*
Force	newton	N	1 N = 1 kg. m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2